Several parts of the very fine "Illustrations of the Zoology of H.M. Indian Marine Surveying Steamer *Investigator*," under the Commander, A. Carpenter, the late Commander, R. F. Hoskyn, and Commander C. F. Oldham, have lately been received. The plates are splendid examples of photo-etchings, and they will be treasured by marine zoologists. Fishes are represented upon sixteen plates, Crustacea upon fifteen plates, and Echinoderma upon five plates. The illustrations are only accompanied by brief explanations, the descriptions of the various species having appeared in the *Annals and Magazine of Natural History*, and in the *Journal of the Asiatic Society of Bengal.* Mr. A. Alcock is responsible for the fishes described and figured, and, in conjunction with Mr. A. R. S. Anderson, for the Echinoderma. The Crustacea have been mostly done under the direction of the late Mr. J. Wood-Mason.

Nearly a year ago (Nature, vol. lii. p. 290), the second volume of the second edition of Dr. George Lunge's treatise on "The Manufacture of Sulphuric Acid and Alkali" (Gurney and Jackson) was reviewed in these columns, and the value of the work to investigators and industrial chemists as a standard work of reference on alkali manufacture was pointed out. The third volume, completing the second edition of the book, has now been published, and the words of praise applied to the second volume are just as fully deserved by the present one. The amplification of the original text has been so considerable, and the revision so thorough, that the work has grown beyond recognition. Only a few chapters resemble those of the first edition, and the chapters on ammonia-soda, on the more recent soda-process, on the Deacon process, and the other chlorine processes, have been entirely rewritten; while a section on the preparation of alkalis, chlorine, and chlorates by electrolysis, appears for the first time. The second edition of the complete work is half as large again as the first; it is well up to date, and forms a most serviceable survey and digest of the whole ground of alkali manufacture.

The meteorological and magnetic observatory of the University of Odessa has for its functions not only the reading of the numerous instruments with which it is equipped, and the discussion of the results observed and registered, but it is intended also to serve as a high school where students of the faculty of physics and mathematics can be trained in the work of meteorology and physical geography. In order to give more importance to this course, Prof. Klossovsky has drawn up a syllabus, which is printed in the 1895 volume of the "Annales" of the Observatory at Odessa. The course is divided into three parts, the first two of which are devoted to fundamental observations, to the installation and study of instruments used in meteorology and terrestrial physics, and to the determination of various elements. The third course is intended for those who propose to take up physical geography or meteorology as a special subject. The programme is an admirable outline of the work of meteorology and terrestrial physics, and but for limit of space we would give a full translation of it. Schools in meteorology are so few, that the development of the curriculum of the Imperial University at Odessa will be welcomed by all who think that trained investigators and experimental work are needed for the advancement of the science.

The additions to the Zoological Society's Gardens during the past week include a Hoolock Gibbon (*Hylobates hoolock*, ♀) from Assam, presented by Mrs. Firman; two Fat Dormice (*Myoxus glis*) from Austria, presented by Mr. John G. Haggard; a Short-toed Eagle (*Circœtus gallicus*) from Egypt, presented by Dixon Bey; a Vulturine Eagle (*Aquila verreauxi*) from South Africa, presented by Mr. J. Clark; two Short-eared Owls (*Asio brachyotus*) from Ireland, presented by Captain R. A. Ogilby; five Cormorants (*Phalacrocorax carbo*) from the Isle of Mull, presented by Maclaine of Lochbuie; three Dwarf Chameleons (*Chamæleon pumilus*) from South Africa, presented by Miss Jessie M. Hudson; eight Natterjack Toads (*Bufo calamita*), two Common Toads (*Bufo vulgaris*), British, presented by Mr. Stanley S. Flower; two Axolotls (*Siredon mexicanus*) from Mexico, presented by Mr. W. Temple; nine Green Turtles (*Chelone viridis*) from Ascension, presented by Mr. J. C. Adlam; a Hoolock Gibbon (*Hylobates hoolock*, ♀) from Assam, an Indian Chevrotain (*Tragulus meminna*), two Indian Drongos (*Chibia hottentota*), two Tigers (*Felis tigris*, ♂ ♀) from India, a Javan Chevrotain (*Tragulus javanica*) from Java, a Harnessed Antelope (*Tragelaphus scriptus*, ♂) from West Africa, deposited.

OUR ASTRONOMICAL COLUMN.

Photographs of Stellar Spectra.—Dr. F. McClean is now engaged on a photographic investigation of the spectra of the northern stars down to the third magnitude. About 160 stars will thus be included in the survey. Some of the results, which have been recently communicated to the Royal Astronomical Society, comprise the spectra of twenty-three characteristic helium stars, and photographs of the spectra of six stars of the third magnitude showing the transitions from one type to another (*Monthly Notices*, vol. lvi. p. 428). The instrument used is a photographic telescope of 12 inches aperture and 11 feet 3 inches focal length, having an objective prism of the same aperture placed in front of the object-glass. The refracting angle of the prism is 20°. The prism is mounted on a hinged frame, and the cell containing it can be rotated within the frame, so that all necessary adjustments can be effected with facility.

The Natal Observatory.—Two reports which have recently been received from Mr. Nevill, the Superintendent of the Natal Observatory, indicate considerable astronomical activity at this southern station. "The principal series of observations in progress is the comparison of the declination deduced from observations made at the observatories in the northern and southern hemispheres by a comparison by Talcott's method of the zenith distance of northern zenith stars and southern circumpolar stars at upper and lower culminations." Over a hundred pairs of stars are under observation. The publication of the Greenwich observations of Mars during the opposition of 1892 renders it possible to utilise the corresponding Natal observations for the determination of a new value of the solar parallax, and this work will be undertaken. During the opposition of Mars in 1894 the weather proved very unfavourable, and no observations of value were secured. A great mass of important work done at the observatory awaits facilities for publication. The entire staff amounts to only four observers and computers, and the instrumental equipment is equally small. The system of time signals and meteorological work were carried on as in former years.

Possible Changes in the Earth's Rotation.—As the result of a recent investigation (*Comptes rendus*, June 1), Prof. Newcomb makes the startling suggestion that the earth's rotation is not perfectly uniform. The discussion was undertaken in connection with the long-period inequalities in the moon's mean motion, which so far have not been satisfactorily explained. The possibility of a variation in the earth's rotation period being admitted, and consequently of an error in our mode of reckoning time, it becomes necessary to employ some method of measuring time which shall be independent of the earth's rotation. This appears to be best furnished by observations of the transit of Mercury. Prof. Newcomb has accordingly discussed all the November transits since 1677, and has compared the observed times of ingress and egress with those computed on the basis of his new tables for the sun and Mercury. Although in many cases the residuals may not be greater than the probable errors, there is a significant systematic character about them, as shown when the observations are grouped as follows:—

Transits.	Residuals. s. s.
1677—1769	−5·4 ± 2·5
1789—1861	+6·4 ± 1·5
1868	−1·5 ± 3·5
1881—1894	−3·1 ± 1·6

It is concluded that "the observations of transits of Mercury clearly indicate small variations in the rotation of the earth, of

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which the integral amount, during long periods of time, probably reaches five, or even ten seconds. In particular it seems that between 1769 and 1789 a retardation of the earth's rotation took place, and another between 1840 and 1861. Towards 1862 this slackening was followed suddenly by a well-marked acceleration, which possible persisted up to 1870."

It may be added that the supposed variation does not seem to account for the lunar inequalities to which reference has been made.

THE LADIES' CONVERSAZIONE OF THE ROYAL SOCIETY.

THE second of the two annual conversaziones of the Royal Society—the one to which both ladies and gentlemen are invited—was held in the room of the Society at Burlington House, on the evening of Wednesday in last week. As many of the scientific novelties exhibited were shown at the conversazione held in May, and have already been described in these columns (May 14), it is unnecessary to refer to them again. Only the new exhibits are therefore described in the present report.

In addition to Mr. Herbert Jackson's demonstration of the various degrees of phosphorescence of different subjects under the action of Röntgen rays, several other exhibits were devoted to methods used and results obtained with the rays. Prof. S. P. Thompson showed the production of electric dust-shadows by Röntgen rays. When the rays are allowed to fall upon an electrified sheet of aluminium placed above a plate of ebonite, they carry electric charges to the plate and electrify it. If objects of metal are laid on the ebonite sheet they intercept the Röntgen rays, and the part of the ebonite surface immediately shaded by them does not become electrified. On removing the ebonite plate and dusting upon it Lichtenberg's powders (mixed sulphur and red lead), the electric shadows become visible.

Prof. Thompson also showed a number of experiments on Röntgen's rays, viz.: (*a*) Cryptoscopic use of luminescent screens (revealing contents of packages, bones of hand, &c.) by employment of focus tube (Jackson's pattern); (*b*) discharge of electroscope by Röntgen rays; (*c*) new forms of X-ray tubes, including one for insertion in mouth; (*d*) apparatus of Ebert for producing luminescence by electric oscillations; (*e*) stereoscopic Röntgen-ray photograph of rabbit.

Electric discharges in vacuum was the subject of exhibits by Messrs. Siemens, Bros., and Co. The exhibits were (1) a facsimile of Dr. Wm. Watson's vacuum tube of 1751. This was the first apparatus ever constructed for experiments on the electric discharge in a vacuum. The discharge from a Leyden jar passed through ten inches, and that from a frictional machine through three feet, the whole length of the tube. (2) Facsimile of Lord Cavendish's double barometer of 1751, used by Dr. Wm. Watson in his researches. (3) Facsimile of Dr. Wm. Morgan's shortened barometer of 1785. Dr. Morgan, by long-continued boiling of the mercury in a barometer tube, produced a vacuum of such excellence that no discharge would pass, and equal, therefore, to that in a Hittorf or Crookes' tube of the present day. It is probable that it would have sufficed for the production of Röntgen rays. (4) Apparatus for showing electric discharges at different degrees of exhaustion from 70 mm. to 0 mm. (5) Photographs obtained by means of Röntgen rays, showing relative transparency of different kinds of wood, minerals, and glass.

A series of striking Röntgen photographs was shown by Dr. Macintyre. The marvellous advance made in Röntgen photography will be understood from the following statement of the subjects of Dr. Macintyre's pictures: (1) *Hard Structures.*—Life-sized photographs of different parts of the human skeleton, including the spine, ribs, shoulder, elbow and other joints of the body. Some of the negatives were 24 by 20 inches. (2) *Animal Kingdom.*—A series of the animal kingdom, such as the fish, frog, adder, &c. (3) *Soft Tissues of the Body in Health and Disease.*—Human heart in the living adult subject. The same in health and disease, also the tongue, tissues of the neck, including the larynx, &c. (4) *Instantaneous Photographs of Different Objects.*—The time of exposure was unknown, but the most rapid picture shown was taken with a single flash of the tube, due to one vibration of the interrupter of a ten-inch spark coil.

Mr. J. J. H. Teall exhibited a series of photographs of the electric discharge at various stages during the exhaustion of a Crookes' bulb of the Jackson type.

A small dynamo for measuring the permeability and hysteresis of iron was exhibited by Prof. W. E. Ayrton and Mr. T. Mather. The specimen to be tested, which may be in the form of a round bar or a bundle of thin plates, forms the yoke of the dynamo, and through a coil surrounding it is passed the magnetising current, the winding of this coil being so arranged that the current in amperes is numerically equal either to the magneto-motive force per centimetre of the bar, or to one-tenth of that value. When the armature is run at a speed of 1150 revolutions per minute, the induction per square centimetre in the bar is approximately equal to 10,000 times the E.M.F. in volts produced. Hence not merely the magnetising current but also the induction is measured by a *steady* deflection, and not, as is usual, by the *instantaneous* swing of a ballistic galvanometer. The magneto-motive force required for the air-gap and joints is determined experimentally by the use of a standard bar whose B H curve is accurately known.

Mr. J. Frith demonstrated the different effects produced by superimposing a small alternating current on a direct current arc according as cored carbons or solid carbons are employed. When a small alternating current is superimposed on a direct current arc formed with *cored* carbons, the oscillations of potential difference and current are in the *same* direction for all frequencies higher than about 1½ periods per second. On the contrary, if the carbon be *solid*, the oscillations of potential difference and current are in the *opposite* direction for all frequencies tried up to 256 periods per second. This difference was exhibited by the visible motion of ammeter and voltmeter needles.

Microscopic internal flaws inducing fracture in steel axles, rails, and propeller shafts were shown by Mr. T. Andrews. This exhibit consisted of a series of accurate micrographs taken at a high magnifying power, illustrative of the microscopically visible and tangible micro-flaws, almost invariably present in considerable number, in steel railway axles, rails, tires, propeller shafts, &c. The presence of these germs of metallic disease in steel (mostly due to sulphur and other impurities) greatly influences the deterioration by fatigue of the metal, and they are a potent factor in inducing the sudden fracture of engineering constructions in steel.

Mr. J. Macfarlane Gray exhibited a multiplication frame. In this contrivance, for obtaining the product of two multidigital numbers, product cards, as on "Napier's rods," are set for one of them upon a sole frame, and sliders on a grid are shifted to set up the other. Each slider has a pane of plass at mid-length. The grid is fitted to the sole frame upon a pair of stepped guides, and is slid along over the cards one figure at a time. At each step the component products in one of the vertical columns of the common multiplication rule are exhibited at the panes and added mentally. In this way the final product is obtained without transcribing the intermediate products.

Exhibits illustrative of applications of the mathematical theory of frequency were shown by the Applied Mathematics Department of the University College, London. They included: (1) Diagram illustrating the relative variation of different organs in men and women of diverse races, by Miss Alice Lee, G. U. Yule, and K. Pearson. (2) Diagrams showing that 25 per cent. of the married population produce 50 per cent. of the next generation—Reproductive Selection, by K. Pearson. (3) Diagrams illustrating barometric frequency over the British Isles, by Miss Alice Lee, C. Jakeman, and K. Pearson. (4) Frequency recording barometer, by G. U. Yule and Cambridge Instrument Co. (5) Amplified integrator for finding mean, mean square and mean cubic deviations, and frequency skewness, by Amsler-Laffon. (6) Prof. Ranke's craniophor, used in comparing variation of skulls, as determined by English and German methods, by A. Martin-Leake and K. Pearson. (7) Skew binomial machine, by G. U. Yule. (8) Model of contour-tracer for finding areas of section of small objects.

Stereoscopic views of algebraic spherical catenaries and gyrostat curves were exhibited by Prof. A. G. Greenhill and Mr. T. I. Dewar. The mathematics of the spherical catenary are discussed in a paper by Prof. Greenhill in the volume of the *Proceedings of the London Mathematical Society* for the current year, and a diagram of a closed algebraical one with five

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